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## Space Weapons and the Law

*Bill Boothby*

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## Space Weapons and the Law

*Bill Boothby\**

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The thoughts and opinions expressed are those of the author and not necessarily of the U.S. government, the U.S. Department of the Navy or the U.S. Naval War College.

## I. INTRODUCTION

It is a regrettable truth that when States find it impossible to resolve their differences by diplomatic interaction, they resort all too often to the use of violence. In the resulting contest, the State with access to the most advanced technology will frequently have a considerable advantage. The contest may take place in any of the known environments: land, sea, airspace, cyberspace and outer space. While the modern era is not without its tensions between States, and while some of these tensions give rise to hostilities, there seems to be a welcome reluctance to extend these hostilities to outer space. That possibility cannot be ruled out, however, and it is doubtful that the reluctance is based in any sense on a taboo as to the deployment of weapons to, or their use in, outer space. There is, at least in some quarters, a recognition that the employment of weapons, particularly kinetic weapons, in space is likely to contribute further to the pressing debris problem, and space-to-ground operations, though theoretically feasible, are perceived as being unnecessarily costly and comparatively less reliable than air-to-ground, littoral or land-based solutions.<sup>1</sup> Moreover, there remains the possibility of other, less kinetic or non-kinetic kinds of offensive operation in outer space. So the awful possibility of warfare in outer space cannot be excluded, and if it were to become a reality, it is important to know the rules that would apply. Accordingly, this article concerns itself with the law that would determine which weapons it would be lawful for a State to employ in that environment.

To accomplish that task it is necessary to understand the general legal principles with which all weapons are required to comply, some treaty-based rules that address the natural environment, the customary and treaty provisions that deal with relevant weapon technologies and the particular provisions of space law that are concerned with weapons. These rules constitute the criteria against which the legal acceptability of a new space weapon must be judged, so it is those rules that States must apply when undertaking the obligatory legal reviews of all new space weapons.

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1. DAVID WRIGHT, LAURA GREGO & LISABETH GRONLUND, *THE PHYSICS OF SPACE SECURITY: A REFERENCE MANUAL* 6 (2005). The reduced reliability is stated to be at least partly due to the inability to maintain space-based systems. *Id.* at 8–9.

Outer space is of critical importance for numerous vital functions in the modern world.<sup>2</sup> In the military context, these include anti-ballistic missile operations, long-range precision strike and ground-based mid-course missile defense missions,<sup>3</sup> intelligence,<sup>4</sup> communications and navigation activities. Were hostilities to break out in outer space, they seem likely to take a variety of forms. They would probably include the direct attack, shading of, or interference with, space assets, such as satellites, using physical,<sup>5</sup> laser or cyber techniques; electronic attack in the form of jamming or spoofing; physical or cyber interference with the movement of targeted space vehicles; laser blinding; and electromagnetic pulse attack.<sup>6</sup> The interception in outer space of transiting missiles is another likely example. Any understanding of the words “weapon” as used in the title of this article and “weaponization” must, therefore, be discussed in the context of these kinds of activity.

Part II will consider and explain the meanings of some important terms in the law relating to weapons. Part III will outline the superfluous injury/unnecessary suffering and indiscriminate weapons principles. Then in Part IV, two rules that seek to protect the natural environment during armed conflict will be explained. Part V will briefly note the ad hoc rules of weapons law that might be of relevance to present and foreseeable space weapon technologies. Part VI will address the rules of space law that are relevant to weapons,

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2. The Multinational Experiment 7 Access to Global Commons report refers to four space pillars to describe the types of capability that space can provide, namely position, navigation and timing; satellite communications; intelligence, surveillance and reconnaissance; and space situational awareness. PROTECTING ACCESS TO SPACE ¶ 114 (Joint Staff-MN//ACT Integration 2013), <https://www.hsdl.org/?view&did=754742>. As to the wider military and civilian utility of facilities provided from outer space, see UNITED KINGDOM MINISTRY OF DEFENSE, DEVELOPMENT, CONCEPTS AND DOCTRINE CENTER, SPACE: DEPENDENCIES, VULNERABILITIES AND THREATS (2012), <https://www.gov.uk/government/publications/multinational-experiment-7-space-dependencies-vulnerabilities-and-threats>. For commercial uses of space, see David A. Koplow, *ASAT-isfaction: Customary International Law and the Regulation of Anti-Satellite Weapons*, 30 MICHIGAN JOURNAL OF INTERNATIONAL LAW 1187, 1190–94 (2009).

3. As to the military utility of space, see Michael N. Schmitt, *International Law and Military Operations in Space*, 10 MAX PLANCK YEARBOOK OF UNITED NATIONS LAW 89, 94–98 (2006); UNITED KINGDOM MINISTRY OF DEFENSE, DEVELOPMENT, CONCEPTS AND DOCTRINE CENTER, JDP 0-30, UK AIR AND SPACE DOCTRINE ¶¶ 508–15 (2013).

4. Consider the improved ground resolution achieved in recent decades. Koplow, *supra* note 2, at 1195.

5. This could take the form of using a satellite to interfere with the command and control channel of another satellite, for example, by interrupting health and status reports and impeding the ability to send commands to the satellite.

6. PROTECTING ACCESS TO SPACE, *supra* note 2, ¶¶ 123–27.

principally in Articles III and IV of the Outer Space Treaty, and Part VII will look at the weapon review obligations of States under Article 36 of Additional Protocol I and under an implied rule for States that are not party to Additional Protocol I. Part VIII will take the criteria that States should address in a weapon review and assess how they may apply in relation to a representative sample of space weapon capabilities. Part IX concludes the discussion.

## II. DEFINITIONS

For the purposes of this article, a weapon is a device, system, munition, implement, substance, object or piece of equipment that is used, intended or designed to cause injury or damage to an adverse party in an armed conflict.<sup>7</sup> The term “means of warfare” refers to weapons and weapon systems,<sup>8</sup> whereas a “method of warfare” is an activity designed to adversely affect the enemy’s military operations or military capacity.<sup>9</sup>

Taking the examples of space capabilities discussed in Part I, a projectile, space vehicle or laser that is used kinetically to attack a space vehicle, thereby causing damage to it, is a weapon by virtue of that use. If a space vehicle undertaking rendezvous and proximity operations is used to cause another space vehicle to move out of position or out of orbit and thus causes the targeted vehicle to be unable to perform its normal functions either permanently or until a repair is effected, this activity damages the targeted vehicle by virtue of the degradation or termination of its ability to perform its assigned tasks, so the instrument that is used to achieve such an effect must be classified as a weapon, due to the use to which it has been put. Moreover, and as a discrete matter, if the activity is “designed to adversely affect the

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7. Justin McClelland, *The Review of Weapons in Accordance with Article 36 of Additional Protocol I*, 85 INTERNATIONAL REVIEW OF THE RED CROSS 397 (2003). Weapons are described in the *HPCR Manual on International Law Applicable to Air and Missile Warfare* as “a means of warfare used in combat operations, including a gun, missile, bomb or other munitions, that is capable of causing either (i) injury to, or death of, persons; or (ii) damage to, or destruction of, objects.” PROGRAM ON HUMANITARIAN POLICY AND CONFLICT RESEARCH, MANUAL ON INTERNATIONAL LAW APPLICABLE TO AIR AND MISSILE WARFARE 6 (2009) [hereinafter AMW MANUAL].

8. YORAM DINSTEIN, THE CONDUCT OF HOSTILITIES UNDER THE LAW OF INTERNATIONAL ARMED CONFLICT 1 (2d ed. 2010).

9. AMW MANUAL, *supra* note 7, r. 1(v).

enemy's military operations or military capacity" it will amount to a method of warfare.<sup>10</sup>

The shading or other interference with an enemy's space assets, such as satellites, with the purpose of adversely affecting the enemy's military operations will, for the same reasons, amount to a method of warfare. Whether the devices or techniques that are used to have such an effect constitute weapons will depend on the precise mechanism or system that is used and on the precise permanent or temporary effects they have on the targeted space vehicle. That mechanism or system may consist of a laser or electromagnetic pulse, a cyber tool or an electronic capability involving jamming. If the mechanism or system causes physical damage to the targeted satellite or if it degrades or terminates the functioning of the satellite, either permanently or so that repair is necessary to restore that functioning, these effects amount to damage and the mechanism or system so employed will be a weapon. Likewise, if what is done to the targeted satellite causes injury or damage to persons or objects that rely on the services that the targeted satellite provides, the mechanism or system will also by virtue of those effects be classified as a weapon. Any such technique that does not cause damage or injury, but that adversely affects enemy military operations or capacity, will, as explained above, constitute a method of warfare.

The interception in outer space of missiles in transit, for example during the boost phase or mid-course, may be undertaken by kinetic, laser or perhaps in the future by cyber means. For obvious reasons, such activities amount to a method of warfare. If, as is assumed, the purpose of the operation is to cause the intercepted missile to be destroyed, thereby preventing it from achieving its originally intended task, the interception mechanism would also amount to a weapon. All of the systems that have been classified as weapons in the foregoing discussion will also be means of warfare, which, as noted earlier, comprise weapons and weapon systems.

The analysis has so far been referring somewhat glibly to "outer space" without specifying what exactly that concept means. There is no precise internationally agreed definition of the altitude(s) from the earth's surface at which outer space begins and airspace ends, but a widely accepted approach is that outer space begins above the highest altitude at which an aircraft can derive lift from its interaction with the air and below the lowest possible perigee of an earth satellite in orbit. Accordingly, anything that is in orbit is

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10. *Id.*

in outer space.<sup>11</sup> A weapon is, for the purposes of this article, a “space weapon” if it operates entirely in outer space. Space weapons do not, therefore, include intercontinental ballistic missiles as these are only in outer space for part of their trajectory and do not go into orbit. Outer space weapons, however, may be located on land, under or on the surface of the sea or in airspace, but they must have their operational effect in outer space.<sup>12</sup> In addition, weapons that are located in and operate from outer space and that have their operational effect in outer space, in airspace, in cyberspace, on or under the earth’s surface are space weapons.

### III. THREE FUNDAMENTAL PRINCIPLES OF WEAPONS LAW

Having clarified the relevant terminology, the three fundamental customary principles in the law relating to weapons will be addressed. The first of these has its origins in 1874 when the authors of the Brussels Declaration acknowledged the notion that “[t]he laws of war do not recognize in belligerents an unlimited power in the adoption of means of injuring the enemy.”<sup>13</sup> This idea was adopted in treaty form in the Hague Regulations of 1899<sup>14</sup> and 1907,<sup>15</sup> and in Article 35(1) of Additional Protocol I (API).<sup>16</sup> The principles considered in the present Part and the rules discussed in Part IV constitute the limitations to which the Brussels Declaration notion is indirectly referring.

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11. U.S. NAVY, U.S. MARINE CORPS & U.S. COAST GUARD, NWP 1-14M/MCWP 5-12/COMDTPUB P5800.7A, THE COMMANDER’S HANDBOOK ON THE LAW OF NAVAL OPERATIONS ¶ 1.10 (2007) [hereinafter COMMANDER’S HANDBOOK]; UNITED KINGDOM MINISTRY OF DEFENCE, THE MANUAL OF THE LAW OF ARMED CONFLICT ¶ 12.13 (2004) [hereinafter UK MANUAL]; AMW MANUAL, *supra* note 7, r. 1(a).

12. Thus, a laser weapon that is located on land, but which is designed to engage targets in outer space would come within this definition of space weapon.

13. Project of an International Declaration concerning the Laws and Customs of War art. 12, Aug. 27, 1874, *reprinted in* THE LAWS OF ARMED CONFLICTS 23 (Dietrich Schindler & Jiri Toman eds., 4th ed. 2004) [hereinafter Brussels Declaration].

14. Regulations Respecting the Laws and Customs of War on Land art. 22, annexed to Convention No. II with Respect to the Laws and Customs of War on Land, July 29, 1899, 32 Stat. 1803, T.S. No. 403.

15. Regulations Respecting the Laws and Customs of War on Land art. 22, annexed to Convention No. IV Respecting the Laws and Customs of War on Land, Oct. 18, 1907, 36 Stat. 2227, T.S. No. 539 [hereinafter 1907 Hague Regulations].

16. Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts, June 8, 1977, 1125 U.N.T.S. 3 [hereinafter API].

In short, international law both provides that there are limits to the lawful ways of injuring the enemy and specifies what those limits are.

The precise language that is used in the following principles and rules is important as it defines the prohibitions and restrictions to which States have been able to agree, and thus the extent of the law's reach.

The second principle prohibits the employment of weapons, projectiles, and material and methods of warfare of a nature to cause superfluous injury or unnecessary suffering. This is a cardinal principle of the law of armed conflict,<sup>17</sup> which is expressed in the 1907 Hague Regulations as a prohibition of the employment of "arms, projectiles or material calculated to cause unnecessary suffering."<sup>18</sup> In its most recent and authoritative treaty articulation, the rule prohibits the employment of "weapons, projectiles and material and methods of warfare of a nature to cause superfluous injury or unnecessary suffering."<sup>19</sup> It is a customary rule that binds all States in relation to international and non-international armed conflicts.<sup>20</sup> The rule first appeared in the preamble to the St. Petersburg Declaration of 1868.<sup>21</sup>

The principle requires a comparison of the wounding effect, injury and other suffering resulting from the use of the weapon, but does not explicitly specify the comparator. Given that weapons are used in order to achieve a military advantage or purpose during armed conflict, the superfluous injury/unnecessary suffering test involves comparing the nature and scale of the generic military advantage to be anticipated from the weapon in the application(s) for which it is designed to be used, with the pattern of injury and suffering associated with the normal intended use of the weapon.<sup>22</sup> While the

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17. Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. Rep. 226, ¶¶ 74–87 (July 8) [hereinafter *Nuclear Weapons*].

18. 1907 Hague Regulations, *supra* note 15, art. 23(e).

19. API, *supra* note 16, art. 35(2). The corresponding language in the Rome Statute of the International Criminal Court is found in Article 8(2)(b)(xx). Rome Statute of the International Criminal Court, July 17, 1998, 2187 U.N.T.S. 90.

20. 1 CUSTOMARY INTERNATIONAL HUMANITARIAN LAW r. 70 (Jean-Marie Henckaerts & Louise Doswald-Beck eds., 2005) [hereinafter CIHL].

21. Declaration Renouncing the Use, in Time of War, of Explosive Projectiles Under 400 Grammes Weight pmbl. paras. 3–6, Nov. 29/Dec. 11, 1868, 138 Consol. T.S. 297, 18 MARTENS NOUVEAU RECUEIL (ser. 1) 474, *reprinted in* THE LAWS OF ARMED CONFLICTS, *supra* note 13, at 91 [hereinafter St. Petersburg Declaration]; GARY D. SOLIS, THE LAW OF ARMED CONFLICT: INTERNATIONAL HUMANITARIAN LAW IN WAR 269–72 (2011).

22. See W. J. Fenrick, *The Conventional Weapons Convention: A Modest but Useful Treaty*, 279 INTERNATIONAL REVIEW OF THE RED CROSS 498, 500 (1990); W. Hays Parks, *Means and Methods of Warfare*, 38 GEORGE WASHINGTON INTERNATIONAL LAW REVIEW 511, 536 n.25 (2006).



application of the principle involves the assessment of phenomena such as suffering, injury and military utility that are hard to measure and difficult to compare, a weapon is not rendered unlawful merely because it causes severe injury, suffering or loss of life. It is the injury or suffering inevitably caused by the weapon in its normal or designed circumstances of use that must be disproportionate to its military purpose or utility for the rule to be broken. Due account must be taken of comparable lawful weapons in current use when making that assessment.<sup>23</sup>

As this discussion has shown, the principle is concerned with the effects of a weapon on personnel and is therefore unlikely, for the foreseeable future, to be relevant to outer space weapons if their effects only occur in outer space. If, as presently seems unlikely,<sup>24</sup> a weapon were to be developed that is located in outer space but has, or is designed or intended to have, injurious effects on persons on the earth's surface or elsewhere, the superfluous injury/unnecessary suffering principle will have to be considered in any legal review of the weapon.<sup>25</sup>

The third principle prohibits the employment of weapons that are of a nature to be indiscriminate. This is a development of the principle of distinction that requires parties to the conflict at all times to distinguish between combatants and civilians and between military objectives and civilian objects and only to direct their military operations against combatants and military objectives.<sup>26</sup> The jurists who drafted the Hague Draft Rules of Aerial Warfare, a text that was never adopted by States and that is not in any formal sense a source of law, produced the first iteration of an indiscriminate attacks rule in Article 24(3).<sup>27</sup> A treaty-based rule prohibiting indiscriminate attacks

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23. See Parks, *supra* note 22.

24. See WRIGHT, GREGO & GRONLUND, *supra* note 1.

25. As to the obligation to review new weapons, means and methods of warfare, see *infra* Part VII.

26. See U.S. Department of War, Instructions for the Government of Armies of the United States in the Field arts. 14, 15, 22, General Orders No. 100, Apr. 24, 1863 [hereinafter Lieber Code]; St. Petersburg Declaration pmb., *supra* note 21; Brussels Declaration, *supra* note 13, arts. 12, 13, 15, 17; 1907 Hague Regulations, *supra* note 15, arts. 23(g), 25, 27. The modern formulation of the principle of distinction is to be found in API, Articles 48, 51 and 52. See API, *supra* note 16, arts. 48, 51–52.

27. Article 24(3) of the Rules concerning the Control of Wireless Telegraphy in Time of War and Air Warfare asserted that in cases where objectives cannot be bombarded without the indiscriminate bombardment of the civilian population, “the aircraft must abstain from bombing.” Rules concerning the Control of Wireless Telegraphy in Time of War and Aerial Warfare art. 24(3), Feb. 19, 1923, 32 AMERICAN JOURNAL OF INTERNATIONAL LAW (Supp.) 12 (1938), reprinted in THE LAWS OF ARMED CONFLICTS, *supra* note 13, at 315.

and indiscriminate weapons did not appear until 1977<sup>28</sup> when API was adopted. In API, Article 51(4) prohibits indiscriminate attacks, i.e., those which:

- (a) . . . are not directed at a specific military objective;
  - (b) . . . employ a method or means of combat which cannot be directed at a specific military objective; or
  - (c) . . . employ a method or means of combat the effects of which cannot be limited as required by th[e] Protocol;
- and [which], consequently, in each such case, are of a nature to strike military objectives and civilians or civilian objects without distinction.<sup>29</sup>

It is sub-paragraphs (b) and (c) that constitute the indiscriminate weapons principle, in that they prohibit weapons, which either because they cannot be directed at a specific military objective or their effects cannot be limited, essentially do not distinguish as required by the principle of distinction.<sup>30</sup> Thus, a space weapon is unlawful if, when used in its normal or designed circumstances, it cannot be directed at a specific military objective or if its effects cannot be reasonably restricted to the target, and, if as a result, its nature is to strike lawful targets, such as military objectives, and protected persons and objects without distinction. Any weapon is capable of being used indiscriminately. The weapons law rule is concerned with the inherent characteristics of the weapon, as opposed to the particular activities of its user.

Applying the principle to outer space weapons, it should be noted that kinetic anti-satellite (ASAT) missiles may contribute to the accumulation of debris in outer space<sup>31</sup> and to the resulting problems that debris causes.<sup>32</sup> At

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28. Neither Article 27 of the 1907 Hague Regulations, nor Article 5 of the 1907 Hague Convention IX explicitly addresses indiscriminate attacks. Convention No. IX Concerning Bombardments by Naval Forces in Time of War, Oct 18, 1907, 36 Stat. 2351, T.S. No. 542.

29. The discrimination rule in Article 51(4) of API is an important element in complying with the principle of distinction. See API, *supra* note 16, art. 51(4).

30. Consider this statement from the *Nuclear Weapons* advisory opinion: “States must never make civilians the object of attack and must consequently never use weapons that are incapable of distinguishing between civilian and military targets.” *Nuclear Weapons*, *supra* note 17, ¶ 78.

31. PROTECTING ACCESS TO SPACE, *supra* note 2, ¶ 102. Note that concentrations of debris have reached a level that risks generating a chain reaction that would deny access to entire areas of outer space. *Id.* ¶ 103. See generally Koplow, *supra* note 2, at 1202–08.

32. See PROTECTING ACCESS TO SPACE, *supra* note 2, ¶ 121. Consider in that regard the debris reportedly caused by the Chinese anti-satellite test attack on January 11, 2007.

the root of the problem is the damaging effect of fragments in outer space, which is attributable to the high speeds at which objects travel in orbit and the tendency for such fragments to remain in orbit, particularly if they are above certain altitudes. An outer space weapon that is designed to kill a satellite by a kinetic impact in medium to high orbit would inevitably create a cloud of debris. That debris can be expected to remain in orbit for a protracted period, if not indefinitely. The individual fragments would be likely to cause damage to any space vehicles, whether civilian or military, and whether they belong to the adverse party to the armed conflict or to a neutral, that happen to pass through the affected area. Any State considering the use of such a method of anti-satellite operation would need to give most careful consideration to the indiscriminate weapons rule and to the proportionality rule as reflected in Article 51(5)(b)<sup>33</sup> of API. Indeed, from a strictly weapons law perspective, it is arguable that such a method of warfare, by virtue of its inherently indiscriminate expected effects, may breach Article 51(4)(c) of API if, for example, the method is employed in parts of outer space where the likelihood of interference with other protected space vehicles is high.<sup>34</sup> Moreover, the potential impact on neutral States of the use of such a method of warfare would have to be assessed and considered.

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Koplow, *supra* note 2, at 1203, 1211. On February 20, 2008, the United States conducted a ballistic missile test attack on its falling USA-193 satellite at a low altitude of 150 miles; most of the 3,000 potentially hazardous fragments reportedly left orbit. *Id.* at 1210. See also Brian Weeden, *Through a Glass, Darkly: Chinese, American and Russian Anti-satellite Testing in Space*, SECURE WORLD FOUNDATION (Mar. 17, 2014), [https://swfound.org/media/167224/through\\_a\\_glass\\_darkly\\_march2014.pdf](https://swfound.org/media/167224/through_a_glass_darkly_march2014.pdf).

33. Article 51(5)(b) of API describes an indiscriminate, and thus prohibited, attack as “an attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated.” API, *supra* note 16, art. 51(5)(b).

34. Koplow, *supra* note 2, at 1245; see also *id.* at 1248. But see Michel Bourbonnière & Ricky J. Lee, *Jus ad Bellum and Jus in Bello Considerations on the Targeting of Satellites: The Targeting of Post-Modern Military Space Assets*, 44 ISRAEL YEARBOOK ON HUMAN RIGHTS 167, 198 (2014) (noting that where the argument is made the focus should be on the former rather than the latter rule). The proportionality rule is, however, an example of the indiscriminate attack rule. A kinetic anti-satellite weapon might be designed to operate in both higher and lower orbits. If operated in low orbit, the resulting debris might not necessarily form a persistent cloud so the use of the weapon might not be rendered indiscriminate by virtue of the debris that the impact causes. Accordingly, such a weapon might not be regarded as indiscriminate by nature. It should, however, be recalled that all of the consequences inevitably associated with the use of a weapon in its normal designed applications should be considered in determining whether it is indiscriminate by nature.

Another aspect of the indiscriminate weapons rule arises when one considers that a single satellite may host a number of networks or links each of which may carry both civilian and military communications traffic. Such a dual-use satellite would be a military objective by virtue of the military function(s) that certain of its networks or links perform. A commander planning to attack such a satellite would have to consider whether the injury to civilians and the damage to civilian objects, including the civilian links hosted by the satellite, are such that an attack may be expected to cause injury and damage that would be excessive in relation to the concrete and direct military advantage anticipated from the attack. That is a targeting law determination that is made by reference to the facts of a particular attack.

The weapon review would likely conclude that the weapon is not per se inherently indiscriminate, if it is capable of engaging a specific military objective such as a military satellite and of limiting its damaging or injurious effects to that specific military satellite. The weapon review will, however, need to explain the proportionality issues that are liable to arise when, for example, dual-use satellites are made the object of attack and will likely discuss feasible precautions that should be adopted to seek to ensure that indiscriminate attacks do not take place. However, mere inconvenience or annoyance caused to civilians due to degraded service from civilian communications, broadcasting, navigation or other facilities attributable to interference with particular satellites and/or their networks would not need to be considered in the proportionality analysis.

If, when the space weapon is being developed or acquired, it is clear that likely uses of it will have the incidental effect of closing down or degrading civilian nodes or networks causing injury to civilians and/or damage to civilian objects, a legal review of the weapon should draw attention to the requirement for a careful proportionality assessment before its use. The review may need to consider alternative methods of achieving the same generic military purpose, and, depending on the circumstances, these might, for example, include temporarily placing the satellite in shadow or using cyber tools directed at the specific network or link that is the object of the attack.<sup>35</sup>

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35. Only incidental death, injury, damage or destruction would fail to be considered in such a proportionality assessment. For the different operating arrangements to which dual-use satellites may be subject and their implications for targeting, see Bourbonnière & Lee, *supra* note 34, at 205–16. Duncan Blake explores the possibilities of disrupting an enemy satellite or converting it to its own use and discusses the use of terrestrially-based capabilities to target ground stations or links to the space-based object, for example, by using electronic

The indiscriminate weapons principle is customary, binding all States irrespective of whether they are party to API, and applies in both international and non-international armed conflicts.<sup>36</sup>

#### IV. WEAPONS LAW RULES RELATING TO THE ENVIRONMENT

There are two rules in relation to the environment that may be relevant when new space weapons are being considered. The first rule deals with damage caused to the natural environment by military activities in armed conflict. The precise form of the rule depends on whether the relevant State is a party to API. For States that are not party to API, customary law treats the natural environment as a civilian object, which as such enjoys general protection from attacks and their effects. As a civilian object, the natural environment may not be made the object of attack and may not be subjected to wanton destruction.<sup>37</sup> This rule is concerned with direct damage to the natural environment, whether as the intended or as the incidental outcome of a military operation.<sup>38</sup> Accordingly, when procuring weapons, all States must have due regard to the impact they may be expected to have on the natural environment.<sup>39</sup>

For States party to API, Article 35(3) prohibits the use of methods or means of warfare that are intended or may be expected to cause widespread, long-term and severe damage to the natural environment, while Article 55(1)

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warfare or cyber methods. Duncan Blake, *Military Strategic Use of Outer Space*, in NEW TECHNOLOGIES AND THE LAW OF ARMED CONFLICT 97, 109 (Hitoshi Nasu & Robert McLaughlin eds., 2014).

36. CIHL, *supra* note 20, r. 71, at 244. In relation to international armed conflicts, see also Rome Statute of the International Criminal Court, *supra* note 19, art. 8(2)(b)(xx).

37. AMW MANUAL, *supra* note 7, rr. 88, 89; TALLINN MANUAL 2.0 ON THE INTERNATIONAL LAW APPLICABLE TO CYBER OPERATIONS r. 143(a) (Michael N. Schmitt ed., 2017). The U.S. *Department of Defense Law of War Manual* notes the “United States has not accepted these provisions [Articles 35(3) and 55 of API]” and concludes that they are “overly broad and ambiguous” and “not a part of customary law,” while also expressing the view that “use of such weapons is prohibited only if their use is clearly excessive in relation to the concrete and direct overall military advantage anticipated.” OFFICE OF THE GENERAL COUNSEL, U.S. DEPARTMENT OF DEFENSE, LAW OF WAR MANUAL § 6.10.3.1 (Dec. 2016) (citation omitted) [hereinafter DOD LAW OF WAR MANUAL]. While the way in which the *Manual* expresses the point can be criticized, it is clear that the United States regards environmental damage as only prohibited when it breaches proportionality.

38. DINSTEIN, *supra* note 8, at 209–12.

39. AMW MANUAL, *supra* note 7, r. 89.

prohibits such methods or means that thereby prejudice the health or survival of the population. The terms “widespread, long-term and severe” apply cumulatively, so if any one of the criteria is absent, the treaty provision will not have been breached. API contains no definition of widespread, long-term and severe, but only the most serious of damage will breach the rule.<sup>40</sup> A number of States when ratifying API made statements excluding the application of, *inter alia*, this rule to nuclear weapons. The United States is not a party to API and explicitly rejects these provisions.<sup>41</sup>

These rules will potentially apply to any space weapon that is designed to have direct or indirect destructive effects on land or in airspace. While the threshold for breaching the API rule is high and significant environmental damage is likely to be necessary before the wanton damage rule would be engaged, the rules applicable to the particular State should be considered in respect of any relevant space weapon.

States party to the Environmental Modification Convention (ENMOD) are prohibited from engaging in military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury to any other State party to that Convention.<sup>42</sup> It is the definition of the term “environmental modification techniques” as “any technique for changing – through the deliberate manipulation of natural processes – the dynamics, composition or structure of the Earth, including its biota, lithosphere, hydrosphere and atmosphere,

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40. See 15 OFFICIAL RECORDS OF THE DIPLOMATIC CONFERENCE OF THE REAFFIRMATION AND DEVELOPMENT OF INTERNATIONAL HUMANITARIAN LAW APPLICABLE IN ARMED CONFLICTS 268 (1978), *reprinted in* COMMENTARY ON THE ADDITIONAL PROTOCOLS OF 8 JUNE 1977 TO THE GENEVA CONVENTIONS OF 12 AUGUST 1949, ¶ 1454 (Yves Sandoz, Christophe Swinarski & Bruno Zimmermann eds., 1987)

The time or duration required (i.e., long-term) was considered by some to be measured in decades. References to twenty or thirty years were made by some representatives as being a minimum. Others referred to battlefield destruction in France in the First World War as being outside the scope of the prohibition. It appeared to be a widely shared assumption that battlefield damage incidental to conventional warfare would not normally be proscribed by this provision. What the article is primarily directed to is thus such damage as would be likely to prejudice, over a long term, the continued survival of the civilian population or would risk causing it major health problems.

41. See *supra* note 37.

42. Convention on the Prohibition of Military or Any Hostile Use of Environmental Modification Techniques art. I, May 18, 1977, 31 U.S.T. 333, 1108 U.N.T.S. 151.

or of outer space”<sup>43</sup> that demonstrates its relevance to the present discussion. So, to come within the prohibition:

1. the dynamics, composition or structure of outer space must have been changed;
2. natural processes must have been manipulated to achieve such an effect;
3. the manipulation must have been deliberate;
4. the use of the technique must have been military or hostile in nature;
5. widespread, long-lasting or severe effects must have resulted;
6. those effects must have been the means of causing destruction, damage or injury to another State; and
7. both States must be party to the Convention.

Because ENMOD only applies if the destruction, damage or injury is caused to another State party, its application is effectively limited to international armed conflicts between States party. Environmental modification would include an attempt to modify the weather by either increasing or reducing rainfall in an area to bring about floods or drought.<sup>44</sup> The results of environmental modification may include earthquakes, tsunamis, a disturbance in the ecological balance of a region, changes in weather and climate patterns.<sup>45</sup> So any technique or weapon operating in or from outer space that is used to trigger environmental modification that produces the prohibited damage and effects is likely to breach the treaty.

## V. AD HOC RULES OF WEAPONS LAW

International law includes rules that prohibit the use of certain weapons or weapon technologies. Not all such rules will be relevant to space weapons.

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43. *Id.* art. II. The term “widespread” has been interpreted as “encompassing an area on the scale of several hundred square kilometres,” while “long-lasting” would involve “lasting for a period of months, or approximately a season” and effects are “severe” if they involve “serious or significant disruption or harm to human life, natural and economic resources or other assets.” 1 Committee on Disarmament, Report of the Conference of the Committee on Disarmament, U.N. Doc. A/31/27, at 91 (1976), *reprinted in* THE LAWS OF ARMED CONFLICTS, *supra* note 13, at 168.

44. PETER ROWE, DEFENCE, THE LEGAL IMPLICATIONS: MILITARY LAW AND THE LAW OF WAR 117 (1987).

45. Committee on Disarmament, *supra* note 43, at 92, *reprinted in* THE LAWS OF ARMED CONFLICTS, *supra* note 13, at 168.

In assessing which rules may be relevant, however, it should be remembered that outer space weapons, as understood for the purposes of the present article, include weapons located in orbit and elsewhere in outer space that have their effects on or under the earth's surface or in the airspace above it. While it is appreciated that there are cost and reliability issues that may render the development of such capabilities unlikely, they should, nevertheless, in the interests of achieving as comprehensive an analysis as possible, be considered. Some weapons prohibitions apply only to States that are party to a relevant treaty, and this is noted where applicable.

#### *A. Poisons and Gases*

Dating from the late Middle Ages, the prohibition of the use of poison or poisoned weapons is reflected in the Lieber Code,<sup>46</sup> the Brussels Declaration<sup>47</sup> and the Oxford Manual,<sup>48</sup> achieving modern treaty law status in the Hague Regulations of 1899 and 1907.<sup>49</sup> It is a customary law prohibition that binds all States in both international and non-international armed conflicts.<sup>50</sup>

Poison or poisoned weapons covers weapons whose primary, or even exclusive, effect is to poison or asphyxiate.<sup>51</sup> The prohibition would therefore extend to using any substance to aggravate a wound and to the poisoning of wells, pumps and rivers from which the enemy draws water supplies.<sup>52</sup> Accordingly, and as an example, the firing from space of a weapon the payload of which is designed to poison the water in a reservoir or irrigation system would be a breach of this prohibition.

It is prohibited to employ asphyxiating, poisonous or other gases, all analogous liquids, materials or devices and bacteriological methods of warfare. After the failure of Hague Declaration 2 of 1899 to prevent extensive

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46. Lieber Code, *supra* note 26, art. 16.

47. Brussels Declaration, *supra* note 13, art. 12.

48. INSTITUTE OF INTERNATIONAL LAW, THE LAWS OF WAR ON LAND [OXFORD MANUAL], art. 8(a) (1880), *reprinted in* THE LAWS OF ARMED CONFLICTS, *supra* note 13, at 29.

49. 1907 Hague Regulations, *supra* note 15, art 23(a).

50. CIHL, *supra* note 20, r. 72.

51. *Nuclear Weapons*, *supra* note 17, ¶ 111.

52. 2 L. OPPENHEIM, INTERNATIONAL LAW: A TREATISE 170–71 (Ronald F. Roxburgh ed., 3d ed. 2005); CIHL, *supra* note 20, at 253; COMMENTARY ON THE ADDITIONAL PROTOCOLS OF 8 JUNE 1977 TO THE GENEVA CONVENTIONS OF 12 AUGUST 1949, *supra* note 40, ¶ 1419.



use of asphyxiating gas during World War I, the 1925 Geneva Gas Protocol<sup>53</sup> was adopted. The Protocol prohibited the use in war of asphyxiating, poisonous or other gases, of all analogous liquids, materials or devices and of bacteriological methods of warfare. Thus, it would be prohibited to employ outer space weapons that are intended, for example, to operate on the earth's surface by deploying asphyxiating or other poisonous gases or by employing bacteriological methods of warfare. This prohibition applies to all States in connection with both international and non-international armed conflicts.

### *B. Fragmentation Weapons*

Adopted under the aegis of the Conventional Weapons Convention,<sup>54</sup> Protocol I provides that "it is prohibited to use any weapon the primary effect of which is to injure by fragments which in the human body escape detection by x-rays."<sup>55</sup> It follows from this provision that the use of any space weapon that is designed for anti-personnel use and that primarily injures by the infliction of fragments that cannot be detected by X-ray is prohibited.

### *C. Laser Weapons*

Adopted under the same Convention, Protocol IV<sup>56</sup> prohibits the employment of "laser-weapons specifically designed, as their sole combat function or as one of their combat functions, to cause permanent blindness to unenhanced vision, that is, to the naked eye or to the eye with corrective eyesight devices."<sup>57</sup> The Protocol draws an important distinction between laser weapons that are specifically designed as a combat function to cause permanent blindness and "[b]linding as an incidental or collateral effect of the legitimate military employment of laser systems, including laser systems used against

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53. Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, June 17, 1925, 26 U.S.T. 571, 94 L.N.T.S. 65.

54. Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects, Oct. 10, 1980, 1342 U.N.T.S. 137.

55. Protocol on Non-Detectable Fragments, Oct. 10, 1980, 1342 U.N.T.S. 168.

56. Protocol on Blinding Laser Weapons, Oct. 13, 1995, 1380 U.N.T.S. 370.

57. *Id.* art. 1. "[P]ermanent blindness' means irreversible and uncorrectable loss of vision that is seriously disabling with no prospect of recovery. Serious disability is equivalent to visual acuity of less than 20/200 Snellen measured using both eyes." *Id.* art. 4.

optical equipment.”<sup>58</sup> This latter incidental or collateral kind of blinding “is not covered by the prohibition of this Protocol.”<sup>59</sup> However, the treaty does require that in the employment of laser systems, States party must “take all feasible precautions to avoid the incidence of permanent blindness to unenhanced vision,” and such precautions should include training and other practical measures.<sup>60</sup>

The important points here from a space weapons perspective are:

1. the mere fact that a space laser weapon is capable of causing incidental or collateral permanent blindness does not per se render it unlawful;
2. a space laser weapon that is specifically designed to cause temporary blindness or to dazzle as a combat function is not rendered unlawful by this provision;
3. when employing space laser weapons to which (1) or (2) above applies, all practicable precautions should be taken to avoid causing permanent blindness, including training and precautions at the time of use; and
4. space laser weapons that are designed to cause damage to other objects or vehicles, whether in outer space, airspace or on the earth’s surface, or which are designed to perform measurement, range-finding or other military tasks, but that do not have a combat function to cause permanent blindness, are not prohibited by this treaty rule.

#### *D. Chemical Weapons*

While the 1925 Geneva Gas Protocol prohibited the use of chemical weapons, it did not prohibit their possession. The 1993 Chemical Weapons Convention<sup>61</sup> addresses that shortcoming. It is an arms control treaty by which is meant that it goes beyond mere prohibition of use by also banning the development, production, acquisition, stockpiling or retention of chemical weapons or their direct or indirect transfer to anyone. States party must not

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58. *Id.* art. 3.

59. *Id.*

60. *Id.* art. 2.

61. Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction, Jan. 13, 1993, 1974 U.N.T.S. 45.

prepare to use them or assist, encourage or induce anyone to do any of these things.<sup>62</sup>

Under the Chemical Weapons Convention, “chemical weapons” are toxic chemicals and their precursors and equipment and munitions connected with their use.<sup>63</sup> “Toxic chemicals” are any chemicals, whatever their origin and however or wherever produced, “which through its chemical action on life processes can cause death, temporary incapacitation or permanent harm to humans or animals.”<sup>64</sup> A “precursor” is “[a]ny chemical reactant which takes part at any stage in the production, by whatever method of a toxic chemical.”<sup>65</sup> Toxic chemicals and precursors that are intended for purposes not prohibited under the Convention may be developed, possessed and used, but only if the types and quantities are consistent with such purposes.<sup>66</sup>

The purposes which are not prohibited under the Convention consist of industrial, agricultural, research, medical, pharmaceutical or other peaceful purposes; protective purposes, namely those purposes directly related to protection against toxic chemicals and to protection against chemical weapons; military purposes not connected with the use of chemical weapons and not dependent on the use of the toxic properties of chemicals as a method of warfare; and law enforcement, including domestic riot control purposes.<sup>67</sup> Law enforcement in this context refers to the enforcement of domestic law.<sup>68</sup>

The prohibitions as to use and possession of chemical weapons now reflect customary law with the result that they bind all States, irrespective of their participation in the Convention, in both international and non-international armed conflicts.<sup>69</sup> It follows from this that no State may use space weapons that come within the definition of chemical weapons. If, for example, a space weapon system were to be developed that through its chemical action on life processes located on the surface of the earth causes death, temporary incapacitation or permanent harm to humans or animals, such a

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62. *Id.* art. I(1).

63. *See id.* art. II(1).

64. *Id.* art. II(2).

65. *Id.* art. II(3).

66. For the precise definition, see *id.* art. II(1).

67. *Id.* art. II(9).

68. David P. Fidler, *The Meaning of Moscow: “Non-Lethal” Weapons and International Law in the 21st Century*, 87 INTERNATIONAL REVIEW OF THE RED CROSS 525, 540–44 (2005).

69. *See* CIHL, *supra* note 20, r. 74. There are now 192 States party to the Chemical Weapons Convention. *Treaties, States Parties and Commentaries*, ICRC, <https://ihl-databases.icrc.org/applic/ihl/ihl.nsf/INTRO/553?OpenDocument> (last visited May 11, 2017).

weapon would be prohibited under the Chemical Weapons Convention and under customary law. The affected humans or animals may be located on land, at sea or on other waters or, less realistically perhaps, in airspace.

#### *E. Biological Weapons*

It will be recalled that the 1925 Geneva Protocol banned bacteriological warfare.<sup>70</sup> This did not, however, prevent the accumulation of stockpiles of bacteriological weapons. That shortcoming was not addressed until the adoption of the Biological Weapons Convention.<sup>71</sup> Article I prohibits the development, production, stockpiling, acquisition or retention (1) of “microbial or other biological agents or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes,” and (2) of “weapons [or] equipment . . . designed to use such agents or toxins for hostile purposes or in armed conflict.”<sup>72</sup> The Fourth Review Conference in 1996 agreed this has the effect of also prohibiting the use of such weapons,<sup>73</sup> although that would, of course, be a moot point for States that were already party to the 1925 Protocol.

The broad selection of activities that are prohibited by the Convention makes it clear that it is another arms control treaty, the prohibitions of which apply to both international and non-international armed conflict. It has been ratified by almost all militarily significant States and the consistent practice of States shows that the prohibitions on possession and use of such weapons, and probably the other prohibitions set forth in the Convention, are now customary and therefore bind all States in relation to both international and non-international armed conflicts.<sup>74</sup>

It is therefore unlawful for any State, whether it is party to these Conventions or not, in any way to equip itself for or undertake a chemical or biological attack using space assets alone or, for that matter, in combination with any other method. Accordingly, no State may develop, produce, stockpile, acquire, retain or use any space weapon or space capability that uses, or

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70. Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, June 17, 1925, 26 U.S.T. 571, 94 L.N.T.S. 65.

71. Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction, Apr. 10, 1972, 26 U.S.T. 583, 1015 U.N.T.S. 163.

72. *Id.* art. I.

73. See UK MANUAL, *supra* note 11, at 104 n.8.

74. See CIHL, *supra* note 20, r. 73.

that contributes in any way to the use, of toxic chemicals or their precursors or microbial or other biological agents or toxins for hostile purposes or in an armed conflict. This prohibition will also apply to the use of viruses.

*F. Incendiary Weapons*

Not all provisions of the law relating to weapons consist of prohibitions. Some provisions are expressed as restrictions on the lawful circumstances in which a particular class of weapon may be used. Incendiary weapons are a case in point. Protocol III<sup>75</sup> to the Conventional Weapons Convention defines incendiary weapons as “any weapon or munition which is primarily designed to set fire to objects or to cause burn injury to persons through the action of flame, heat, or a combination thereof, produced by a chemical reaction of a substance delivered on the target.”<sup>76</sup>

The Protocol provides that “[i]t is prohibited in all circumstances to make any military objective located within a concentration of civilians the object of attack by air-delivered incendiary weapons.”<sup>77</sup> It is also prohibited to make military objectives located within a “concentration of civilians”<sup>78</sup> the object of attack using incendiary weapons other than air-delivered incendiary weapons

except when such military objective is clearly separated from the concentration of civilians and all feasible precautions are taken with a view to limiting the incendiary effects to the military objective and to avoiding, and in any event to minimizing, incidental loss of civilian life, injury to civilians and damage to civilian objects.<sup>79</sup>

Furthermore, the Protocol prohibits making forests or other kinds of plant cover the object of attack using incendiary weapons except when such

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75. Protocol on Prohibitions or Restrictions on the Use of Incendiary Weapons, Oct. 10, 1980, 1342 U.N.T.S. 171.

76. *Id.* art. 1(1). The definition notes that such weapons can take a variety of forms, but excludes munitions with incidental incendiary effects, such as tracers or illuminants, smoke or signaling systems and combined effects munitions in which the incendiary effect is designed to be used against objects not persons.

77. *Id.* art. 2(2).

78. A “concentration of civilians” may be permanent or temporary, and can include inhabited parts of cities, towns, villages, camps, columns of refugees or groups of nomads. *Id.* art. 2.

79. *Id.* art. 2(3).

natural elements are used to cover, conceal or camouflage combatants or other military objectives, or have themselves become military objectives.<sup>80</sup>

The difficult question that arises from this is which kinds of weapon that might be used in or from outer space would be caught by the incendiary weapon definition. Clearly, if an inflammable substance were to be deployed from outer space against a target on land, the prohibition of attacking military objectives located within concentrations of civilians using air-delivered incendiaries would become relevant. The prohibition would also be relevant if an aircraft, whether piloted or remotely piloted, uses space-based facilities to enable it to prosecute such an attack. If, alternatively, a powerful laser not prohibited by Protocol IV were to be deployed to outer space for use, *inter alia*, against targets on the earth's surface, the important questions to consider under Protocol III would be whether the laser is primarily designed to set fire to objects or to burn persons. The next question would be whether the weapon is designed to do this through the action of flame, heat or a combination of the two; and, the third question to ask is whether this effect is produced by a chemical reaction of a substance delivered to the target. Much will depend on the particular weapon being assessed, but the present author considers that even if the first two of these questions is answered in the affirmative, the third is not likely to be. In all probability there will not be a "substance" delivered to the target and the effect on the target is likely to be occasioned directly by the directed energy in the laser beam, not through any kind of chemical reaction. Nevertheless, these and other factors should be considered carefully when any such space weapon that is being designed for purposes of the sort discussed above is being evaluated in a weapon review.<sup>81</sup>

#### G. Nuclear Weapons

In international law there is no specific prohibition on, nor any explicit permission for, the use of, or threats to use, nuclear weapons. Any such use or threat is unlawful unless it complies with the general principles of international law and the rules of the law of armed conflict.

The International Court of Justice considered these matters and in July 1996 issued its comprehensive advisory opinion as to the legality of the threat or use of nuclear weapons. It came to the conclusion that there is in neither

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80. *Id.* art. 2(4).

81. *See* Part VII.

customary nor in conventional international law any specific authorization for the threat or use of nuclear weapons, but neither is there in either customary or conventional international law any comprehensive and universal prohibition of the threat or use of nuclear weapons.

The Court noted that a threat to use, or use of, nuclear force that is contrary to Article 2(4) of the UN Charter and that fails to meet the requirements of Article 51 is unlawful, and that such a threat or use should be compatible with the law of armed conflict and with treaties and other undertakings dealing expressly with nuclear weapons.<sup>82</sup> Having acknowledged that the threat or use of nuclear weapons would generally be contrary to the law of armed conflict, the Court stated that it could not “conclude definitively whether the threat or use of nuclear weapons would be lawful or unlawful in an extreme circumstance of self-defense, in which the very survival of a state would be at stake.”<sup>83</sup>

There has been no shortage of criticism of this *non liquet* judgment by the Court,<sup>84</sup> but the propositions in the judgment, unsatisfactory as some commentators consider them to be, will remain the position of the Court on the matter unless and until the issue is further adjudicated. Accordingly, the possession of nuclear weapons as such does not breach any specific rule under the law of armed conflict. States are, however, bound by any other relevant treaties to which they are party such as the Nuclear Non-Proliferation Treaty.<sup>85</sup> Of more specific relevance in the context of outer space, the Outer Space Treaty<sup>86</sup> includes specific provision in respect of nuclear weapons and weapons of mass destruction, which will be discussed in Part VI below.

A number of States ratified API subject to a statement to the effect that the new rules introduced by the treaty would not apply to nuclear weapons.<sup>87</sup>

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82. *Nuclear Weapons*, *supra* note 17.

83. *Id.* at 267.

84. See, e.g., Timothy L. H. McCormack, *A Non Liquet on Nuclear Weapons – The ICJ Avoids the Application of General Principles of International Humanitarian Law*, 316 INTERNATIONAL REVIEW OF THE RED CROSS 76 (1997); Christopher Greenwood, *The Advisory Opinion on Nuclear Weapons and the Contribution of the International Court to International Humanitarian Law*, 316 INTERNATIONAL REVIEW OF THE RED CROSS 65, 73 (1997).

85. Treaty on the Non-Proliferation of Nuclear Weapons, July 1, 1968, 21 U.S.T. 483, 729 U.N.T.S. 161.

86. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

87. See, for example, the statement made by the United Kingdom on ratification of API on January 28, 1998 [hereinafter UK Statement], the first statement made by Belgium on ratification of API on May 20, 1986, the first statement by Italy on ratification of API

The specific rules that were considered to be covered by these declarations were not explicitly specified, but are generally recognised as including the environmental protection rules in Articles 35(3) and 55 and the prohibition on taking reprisals against civilians and civilian objects. The present author has in the past argued that they also include the indiscriminate weapons principle.<sup>88</sup> The proportionality and discrimination rules<sup>89</sup> do, however, apply to any use of nuclear weapons, but there is no evidence that the relevant States have resiled from their declarations as they apply to the environmental protection, and potentially to the indiscriminate weapons rules. The lawfulness of taking the reprisal action addressed in API will depend on the position taken by the relevant State when ratifying that treaty.<sup>90</sup>

States that do not have nuclear weapons are bound under Article II of the Non-Proliferation Treaty not to receive the transfer from any transferor whatsoever of nuclear weapons or nuclear explosive devices or of control over them, and not to seek or receive any assistance in the manufacture of such weapons or explosive devices.<sup>91</sup>

## VI. SPACE LAW'S RULES RELATING TO WEAPONS

The treaty law explicitly dealing with weapons in outer space and with the conduct of armed conflict there is relatively sparse. Article III of the Outer Space Treaty does, however, provide that all uses of outer space must be “in accordance with international law.”<sup>92</sup> This is an important provision because it has the clear effect, in the context of the present article, of applying to space weapons the customary principles and rules of weapons law and those of its treaty rules that can sensibly be interpreted as extending to outer space.

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on February 27, 1986, and statement 2 made by France on ratification of API on April 11, 2001. *Treaties, States Parties and Commentaries*, ICRC, <https://ihl-databases.icrc.org/ihl> (follow “Additional Protocol (I) to the Geneva Conventions, 1977” hyperlink then “State parties” hyperlink then “Reservation/Declaration” hyperlink for each country) (last visited May 11, 2017).

88. WILLIAM H. BOOTHBY, *WEAPONS AND THE LAW OF ARMED CONFLICT* 65 (2d ed. 2016); see also Frits Kalshoven, *Arms, Armaments and International Law*, 191 RECUEIL DES COURS 236, 287 (1985-II).

89. API, *supra* note 16, arts. 51(5)(b) and 51(4), respectively.

90. Consider in that regard the statement made by the United Kingdom on ratification of API on January 28, 1998. UK Statement, *supra* note 87.

91. Treaty on the Non-Proliferation of Nuclear Weapons art. II, July 1, 1968, 21 U.S.T. 483.

92. Outer Space Treaty, *supra* note 86, art. III.



The application of the superfluous injury/unnecessary suffering and indiscriminate weapons principles, so far as that application makes sense, is not controversial. The environment-related rules will apply, as has been seen, to any space-based weapons that have effects in airspace, on the earth's surface or beneath it. Likewise, Part V has addressed the ad hoc rules of weapons law that are potentially relevant to space weapons.

In so far as it is relevant to the present discussion, Article IV of the Outer Space Treaty requires States parties

not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner. . . . [and states that] the . . . testing of any type of weapons . . . on celestial bodies shall be forbidden.<sup>93</sup>

Bourbonnière and Lee explain that this provision would not prohibit the use of conventional space weapons that have a nuclear power source as these are not weapons of mass destruction as understood in the treaty.<sup>94</sup> This provision does not prohibit the deployment of conventional weapons<sup>95</sup> in outer

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93. Outer Space Treaty, *supra* note 86, arts. IV(1)–(2). The establishment of military bases, installations and fortifications, the testing of any type of weapons, and the conduct of military maneuvers are prohibited on the moon and other celestial bodies. Conventional weapons and military space stations can be placed in orbit and space-based exercises and weapons testing are permitted in outer space but not on celestial bodies. Schmitt, *supra* note 3, at 104. So, for example, testing a weapon against a satellite would not breach Article IV of the Outer Space Treaty. *But see* Treaty Banning Nuclear Testing in the Atmosphere, Oceans and Outer Space art. 1, Aug. 5, 1963, 14 U.S.T. 1313, T.I.A.S. No. 5433, 480 U.N.T.S. 43.

94. Contrast this with a weapon system that relies on nuclear weapons to generate power. Michel Bourbonnière & Ricky J. Lee, *Legality of the Deployment of Conventional Weapons in Earth Orbit: Balancing Space Law and the Law of Armed Conflict*, 18 EUROPEAN JOURNAL OF INTERNATIONAL LAW 873, 881–82 (2008).

95. *Id.* at 875 n.84. “Conventional weapons” is used here to refer to weapons that are not nuclear weapons or weapons of mass destruction. Compare this with the draft Prevention of the Placement of Weapons Treaty submitted in 2008 by Russia and China to the Conference on Disarmament, which provided

The States Parties undertake not to place in orbit around the Earth any objects carrying any kinds of weapons, not to install such weapons on celestial bodies and not to place such weapons in outer space in any other manner; not to resort to the threat or use of force against outer space objects; and not to assist or induce other States, groups of States or international organizations to participate in activities prohibited by this Treaty.

space nor does it prohibit nuclear weapons and weapons of mass destruction entering outer space as part of the trajectory of an intercontinental ballistic missile.<sup>96</sup> The provision does, however, prohibit the stationing of biological and bacteriologic weapons, of chemical weapons and of nuclear weapons in outer space and the placing of such weapons in orbit. Accordingly, the term “weapons of mass destruction” must be taken to include chemical weapons under the Chemical Weapons Convention and biological or bacteriological weapons under the Biological Weapons Convention.

There is an obligation to register space objects<sup>97</sup> and to mark appropriately such objects used for military purposes, but Bourbonnière and Lee draw attention to the danger that the information that must be disclosed under Article IV of the Registration Convention may be used for targeting purposes.<sup>98</sup> Nevertheless, this is an obligation to which attention should be drawn if a space vehicle is the subject of a weapon review.

## VII. WEAPON REVIEWS OF SPACE WEAPONS

International law requires every State to determine whether the employment by it of a new weapon would in some or all circumstances breach the rules of international law applicable to that State. This is an implied rule derived from a number of other legal rules to which States are subject. Consider in this regard the 1868 St. Petersburg Declaration,<sup>99</sup> Article 1 of Hague Convention II of 1899<sup>100</sup> and Article 1 of Hague Convention IV of 1907.<sup>101</sup> The latter provisions require States party to issue instructions to their armed land

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Letter dated February 12, 2008 from the Permanent Representative of the Russian Federation and the Permanent Representative of China to the Conference on Disarmament addressed to the Secretary-General of the Conference transmitting the Russian and Chinese texts of the Draft “Treaty on Prevention of the Placement of Weapons in Outer Space and of the Threat or use of Force against Outer Space Objects (PPWT)” introduced by the Russian Federation And China, Doc. CD/1839 (Feb. 29, 2008).

96. DOD LAW OF WAR MANUAL, *supra* note 37, ¶ 14.10.3.1. Contrast this with the reference to a fraction of an earth orbit in certain arms reduction treaties. *Id.*

97. Convention on Registration of Objects Launched into Outer Space art. II, Jan. 14, 1975, 28 U.S.T. 695, 1023 U.N.T.S. 15.

98. Bourbonnière & Lee, *supra* note 94, at 895; *see id.* at 896–98.

99. Note in particular the final paragraph of the St. Petersburg Declaration, *supra* note 21.

100. Convention (II) with Respect to the Laws and Customs of War on Land art. 1, July 29, 1899, 32 Stat. 1803, T.S. No. 403.

101. Convention (IV) Respecting the Laws and Customs of War on Land art. 1, Oct. 18, 1907, 36 Stat. 2227, T.S. No. 539.

forces “in conformity with the Regulations” annexed to those instruments.<sup>102</sup> Common Article 1 to the 1949 Geneva Conventions specifies the obligation of States to respect, and to ensure respect, for the Conventions, and the terms in which a number of weapon treaties are written imply a continuing requirement for States to satisfy themselves that the weapons they acquire and use comply therewith. The International Committee of the Red Cross suggests that “[t]he requirement that the legality of all new weapons, means and methods of warfare be systematically assessed is arguably one that applies to *all* States, regardless of whether or not they are party to Additional Protocol 1.”<sup>103</sup> The present author takes the view that the requirement confronting States that are not party to API is limited to the legal review of new weapons. While relatively few States are known to have systems for the legal review of new weapons,<sup>104</sup> even fewer States are known actually to conduct legal reviews of methods of warfare.

States that are party to API are subject to a rather more extensive obligation. They are obliged “[i]n the study, development, acquisition or adoption of a new weapon, means or method of warfare . . . to determine whether its employment would, in some or all circumstances, be prohibited by this Protocol or by any other rule of international law applicable to the High Contracting Party.”<sup>105</sup>

The law that should be applied during these weapon reviews includes the principles and rules that were discussed in Parts III–VI to the extent that those rules bind the State in question. Thus, the criteria to be applied in order to determine the lawfulness of a new space weapon system will consist of

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102. See, e.g., W. Hays Parks, *Conventional Weapons and Weapons Reviews*, 8 YEARBOOK OF INTERNATIONAL HUMANITARIAN LAW 55, 55–57 (2005). There it is noted that an important State not party to API, the United States, legally reviews the new weapons that it acquires and has done so for many years.

103. International Committee of the Red Cross, *A Guide to the Legal Review of New Weapons, Means and Methods of Warfare: Measures to Implement Article 36 of Additional Protocol I of 1977*, 88 INTERNATIONAL REVIEW OF THE RED CROSS 931, 933 (2006) [hereinafter ICRC Guide] (emphasis in original). See also AMW MANUAL, *supra* note 7, r. 9; TALLINN MANUAL 2.0 ON THE INTERNATIONAL LAW APPLICABLE TO CYBER OPERATIONS, *supra* note 37, r. 110(a) (noting that the commentary to Rule 110(a) cites Common Article 1 to the Geneva Conventions of 1949); UK MANUAL, *supra* note 11, ¶¶ 6.20–6.20.1; COMMANDER’S HANDBOOK, *supra* note 11, ¶ 5.3.4; CHIEF OF THE GENERAL STAFF (CANADA), B-GJ-005-104/FP-021, LAW OF ARMED CONFLICT AT THE OPERATIONAL AND TACTICAL LEVELS ¶ 530 (2001); FEDERAL MINISTRY OF DEFENCE (GERMANY), ZDV 15/2, LAW OF ARMED CONFLICT MANUAL ¶ 405 (2013).

104. ICRC Guide, *supra* note 103, at 5.

105. API, *supra* note 16, art. 36.

the rules of international law that bind the State in question, namely the customary principles and rules supplemented by rules set forth in the treaties to which the State is party.

For States party to API, the obligation to review the lawfulness of a space weapon, means or method of warfare in outer space first arises with its study. “Study” is probably best understood as including the first consideration or evaluation of particular kinds of weaponization of a technology.

“Development,” as that term is used in Article 36 of API, includes the actual creation of the space weapon and its improvement, refinement and testing,<sup>106</sup> while “acquisition” of space weapons includes obtaining them from commercial undertakings and/or from other States. The “adoption” of a method of space warfare seems to contemplate a State or its armed forces deciding to use a space weapon or method of space warfare in military operations.<sup>107</sup>

When a State undertakes a weapon review, it should consider the general circumstances in which it is intended to use the weapon, means or method of warfare, and should assess whether existing law, that is the body of international law by which the relevant State is bound, prohibits the use of the weapon or method, or restricts those general intended circumstances of use. If the latter is the case, the document that contains the weapon review should specify the legal limitations on the lawful use of the weapon or method.

There is no international law rule that requires that the weapon review have any particular form, nor is there any particular procedure that the weapon review process must follow. In some cases, advice to an appropriate commander, whether oral or written, may, depending on the circumstances, be sufficient.<sup>108</sup>

It is therefore clear that any State that is acquiring a space weapon must conduct a legal review of that weapon to determine whether the principles and rules discussed in this article prohibit the use of that weapon or restrict its circumstances of lawful use. States that are party to API must undertake a weapon review when a space weapon is being studied and/or when it is being developed. API States must also conduct a legal review into any new

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106. See Isabelle Daoust, Robin Coupland & Rikke Ishoey, *New Wars, New Weapons? The Obligation of States to Assess the Legality of Means and Methods of Warfare*, 84 INTERNATIONAL REVIEW OF THE RED CROSS 345, 348 (2002).

107. See *supra* Part II for an explanation of the terms “weapon,” “method of warfare” and “means of warfare.”

108. TALLINN MANUAL 2.0 ON THE INTERNATIONAL LAW APPLICABLE TO CYBER OPERATIONS, *supra* note 37, at 465 ¶ 4.

method of space warfare that they are studying, developing and/or that they plan to adopt.

The criteria that should be applied in such a legal review are as follows:

- Is the weapon system of a nature to cause superfluous injury or unnecessary suffering?
- Is the weapon system indiscriminate by nature?
- For States that are party to API, is the weapon intended, or may it be expected, to cause widespread, long-term and severe damage to the natural environment?
- For States that are not party to API, is the use of the weapon going to be consistent with the State's obligation to have due regard to the natural environment?
- For States that are party to ENMOD, would the use of the weapon involve environmental modification techniques of the sort and involving the consequences prohibited by the ENMOD Convention?
- Are there ad hoc weapons law rules that apply to the weapon?

#### VIII. APPLYING THE RULES TO PARTICULAR SPACE TECHNOLOGIES

In this Part, the weapon review criteria that have been identified at the end of Part VII will be applied to some representative space weapon capabilities with a view to identifying which among them seem likely to be most relevant when conducting a legal review of these particular types of weapons. The weapon technologies that will be considered are, inevitably, expressed in generic terms, but are intended to constitute a reasonably representative sample of the types of space weapon that States may be expected to procure.

##### *A. Kinetic Anti-Satellite Operations*

The first kinds of weapon to be addressed are those associated with kinetic anti-satellite (ASAT) operations. These may, for example, involve the use of fixed or mobile direct ascent ASAT launchers, frequently rockets, to deliver an attack vehicle to the target satellite; the placement in orbit of an interceptor vehicle that subsequently attacks the target satellite; or the release of a cloud of pellets into the path of the satellite.<sup>109</sup> In the case of interceptor

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109. Space basing is considered to be unsuitable for ballistic defense using kinetic interceptors, partly owing to the expense and partly due to intrinsic vulnerabilities that would

operations, other systems track the target satellite communicating the required data to the interceptor vehicle, which then homes in on the satellite. Assuming that in all of these kinds of kinetic operation the space weapon system is intended to damage or otherwise degrade a target satellite, certain aspects of the weapon review criteria will likely be of little or no relevance. If, as seems likely, no injury or suffering to persons is being caused by the operation of the weapon, the superfluous injury/unnecessary suffering principle will not require detailed consideration. Similarly, if the environment of the earth is not being damaged as a result of the operation and if the environment is not being used as a weapon, the environmental protection rules are unlikely to be relevant to the weapon review. There is, moreover, no ad hoc rule of weapons law that prohibits or restricts the use of kinetic ASAT weapons of the kind being discussed here.

The indiscriminate weapons principle is, however, likely to require careful consideration. There are likely to be two aspects to the matter. The first concerns the ability of the weapon system considered as a whole, including the persons who are operating the weapon system, to verify that the chosen target is, and at the time of attack remains, a military objective. The second concerns the ability of the weapon system, including those who are operating the system, to take the precautions required by targeting law, including their ability to determine whether the attack on the target satellite may be expected to cause injury to civilians, damage to civilian objects or a combination thereof which is excessive in relation to the anticipated concrete and direct military advantage.

The weapons law issues here are not whether a particular attack will, or will not, engage a military objective or comply with the proportionality rule. Rather, the issues are whether the space weapon system as a whole, incorporating as it will the persons involved in its operation, is capable of (a) verifying that the target space vehicle, e.g., a satellite, is a military objective; (b) applying the precautions in attack prescribed by the law of targeting;<sup>110</sup> and (c) making the determinations required by the proportionality rule. Making the required determinations presupposes that sufficient knowledge can be gained as to the uses to which the target satellite is put for those operating the space weapon system to have the practical possibility to make that proportionality judgment. The obligation to take constant care will require that

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allow an attacker readily to negate its defensive capability. WRIGHT, GREGO & GRONLUND, *supra* note 1, at 7. Releasing a cloud of pellets in the path of the target satellite may prove less effective than the other methods of kinetic attack. *Id.* at 10.

110. See API, *supra* note 16, art. 57.

the weapon system or those operating it shall be able to review the status of the target as a military objective and the proportionality of the planned attack up to the point when the attack is initiated, and for as long thereafter as suspension of the attack remains technically and practically feasible.<sup>111</sup>

Kinetic interceptors that destroy a satellite by explosion or direct impact may be expected to cause debris, which, if the event occurs at altitudes greater than the lower end of low earth orbit, may be expected to create a cloud of debris that is unlikely to leave orbit for the foreseeable future. It will be appreciated that the proportionality rule refers to *expected* injury to civilians and damage to civilian objects. The extent, density and location of the cloud, and its expected movements over time, are likely to determine whether such damage can be expected. Moreover there is no specific rule explicitly prohibiting kinetic ASAT attacks. However, the growing debris problem that is being experienced causes one to wonder for how long kinetic ASAT activities will continue to be acceptable among spacefaring nations. The author takes the view that kinetic ASAT operations that are likely to cause debris clouds in areas of outer space that civilian satellites may be expected to use are likely to be regarded as breaching the indiscriminate attacks rule, a factor to which attention should be drawn in any weapon review.

#### *B. Missile Defense Operations*

Missile defense operations involve the detection, tracking and targeting of enemy missiles. Space-based systems may be used for the detection and tracking elements in the process, but the engagement of the missiles seems likely to involve ground-based missile systems or ground-based lasers. As these operations essentially involve the use of a space weapon system to attack and destroy missiles in outer space, for essentially similar reasons to those noted in the discussion of ASAT operations, the superfluous injury/unnecessary suffering principle is unlikely to be particularly relevant to the weapon review. The space weapon is being used to counter the threat posed by the enemy's weapon systems and is not likely, it is suggested, to involve environmental modification techniques. On the assumption that as some of the debris from such operations reaches the earth is unlikely to cause widespread, long-term and severe damage to the environment, the environmental protection rules would also seem to be of little or no relevance to a

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111. "In the conduct of military operations, constant care shall be taken to spare the civilian population, civilians and civilian objects." *Id.* art. 57(1).

weapon review. There are no ad hoc weapons rules under the law of armed conflict that apply to technology of this kind. States will, of course, have to review their obligations under arms reduction/limitation and disarmament treaties to ensure that those obligations are complied with. Indeed, that is a matter of general application to space capabilities that are addressed by the relevant treaties.

As was the case with ASAT operations, the focus of attention in a weapon review of a missile defense capability is likely to be on the indiscriminate weapons principle. The space weapon system will be designed specifically to locate, track and engage objects that are military objectives, e.g., enemy missiles and rockets. It is therefore most unlikely that a weapon review would find that such a system that in testing is found to engage the intended targets with acceptable reliability is nevertheless indiscriminate. Put another way, if the weapon system performs its assigned military task with the required efficiency, it is likely to pass the indiscriminate weapons test.

The weapon review should, however, consider all relevant aspects of the matter fully. So if, for example, such systems are being set up to address threats from foreseen localities, the weapon review should recommend that feasible precautions should be taken to seek to limit the exposure of densely populated areas to dangers arising from falling debris. Testing of the space weapon system in advance of procurement should be designed to show that it will reliably only engage objects that are military objectives and does not, for example, mistakenly target civilian aircraft. This may require the careful configuration of any automated or autonomous target recognition systems, the facilitation of appropriate human supervision of the operation of the system if this is necessary to ensure that only lawful targets are engaged, and the practical ability of a human operator to intervene if necessary. Realistic testing, both by means of live firing and computer modelling, of the performance of these functions will be an essential element in support of the review. As has been made clear, if the weapon systems forming part of a missile defense system are capable of engaging objects that are military objectives, they will likely satisfy the indiscriminate weapons principle. Any operating procedures or caveats as to their permitted circumstances of operation that are required to ensure that their use is discriminating will have to be spelled out in the weapon review and must be implemented by those operating such systems.

Kinetic interception operations of this kind are likely to produce debris. It is, however, only the debris that will enter and remain in orbit that will contribute to the space debris problem discussed earlier. If, as seems likely,



the debris resulting from such interception operations does not achieve the required velocities to enter orbit but may be expected, instead, to enter the atmosphere, the fact that debris has been caused will not involve the particular indiscriminate weapon considerations that have been discussed above.

### C. Jamming

Jamming of targeting or tracking capabilities of missile defense systems is likely to cause the performance of such systems to be at least degraded, resulting for example in missiles missing their targets. Jamming of positioning, navigation and timing systems and of satellite communications may have far-reaching consequences. Jamming of communications systems may cause the service to be interrupted, although it may be possible to defeat jamming by encryption. The points made in this sub-Part will apply equally in the case of the employment of high-power microwave systems deployed to space in order to adversely affect the operation of a target satellite. If particular considerations only apply to high-power microwave systems, this is made clear.

If, as will usually be the case, most military communications are encrypted, this implies that jamming may have a greater impact on civilian than on military traffic, depending on the system that is being jammed and the services it supports. It should be borne in mind, however, that jamming operations that do not cause injury or physical damage are unlikely to be classified as an attack,<sup>112</sup> with the consequence that the equipment or capability employed to undertake such operations will not be classified as a weapon. However, any such technique that does not cause damage or injury but that adversely affects enemy military operations or capacity will constitute a method of warfare and, accordingly, States party to API would be legally obliged to subject it to weapon review. States not party to API would have no such obligation.

Turning to the weapon review criteria that must be considered and on the assumption that jamming operations do not cause any injury or illness to persons, the superfluous injury/unnecessary suffering test is likely to be of little or no relevance. In a weapon review of a high-power microwave system, it will be necessary for the reviewer to assess whether the system will cause

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112. An attack is defined by API, Article 49(1) as an “act[] of violence against the adversary, whether in offence or in defence.” API, *supra* note 16, art. 49(1). Violence has, for these purposes, been interpreted as involving violent consequences, namely injury or damage.

injury or suffering to enemy combatants and, if so, whether there is a corresponding military purpose or military utility. It is useless injury or suffering that is the inevitable consequence of the normal use of the weapon in the designed or intended manner of use that the rule prohibits. So the reviewer will require tests to be undertaken to determine whether injury or sickness is caused by the weapon, how severe that injury or sickness is, and whether the injury or suffering are unnecessary or superfluous as discussed in Part III.

Jamming is unlikely to have any direct impact on the environment and is unlikely to use the environment as a weapon, at least not in the sense referred to in ENMOD. The environmental protection rules discussed in Part IV will also therefore not be considered further. There are no ad hoc rules of weapons law that affect the conduct of jamming operations. Where the indiscriminate weapons rule is concerned, if the jamming tool is capable of selecting the frequency, network or node to be jammed and of reasonably limiting its effects to that frequency, network or node, it is unlikely to be found indiscriminate by nature and is therefore unlikely to breach the rule. The weapon review may, however, need to draw attention to the need to determine in advance which other networks, frequencies or nodes are likely to be affected by the jamming operation. If the effect of the jamming on those would be to cause injury or damage, then the jamming tool will, on this basis if on no other, be regarded as a weapon, and use of it occasioning such injurious or damaging incidental effects would be classified as an attack.

If the jamming has no damaging, injurious or harmful effect and if its only effect is to cause inconvenience or annoyance, the principle of distinction will not apply and the indiscriminate weapons rule would therefore not apply to the devices or capabilities used to undertake the jamming. If, however, the jamming does have a damaging or injurious effect, the prohibition of weapons that are indiscriminate by nature will apply and a weapon review will need to consider whether the weapon, i.e., the jamming capability, can be directed at a specific military objective and whether it is feasible for those conducting such operations to take the precautions required by Article 57 of API. Although this is a targeting law as opposed to a weapons law point, it should nevertheless be pointed out that if a jamming system creates effects consisting of both inconvenience or annoyance and damage or injury, the damage or injury must be considered in applying the proportionality rule, whereas the inconvenience and annoyance, whether suffered by combatants or civilians, can be ignored.

If the weapon review is assessing a high-power microwave system, the issue is likely to be whether the system is capable of being directed at a specific military objective, i.e., a satellite, and whether its damaging effects can reasonably be limited to the military objective. One would rather expect that the answers to both questions will be in the affirmative. If no damage or injury is either caused or intended, then the microwave system is not a weapon, but before adopting such a method of warfare, an API State must nevertheless conduct a legal review of the system.

#### *D. Satellites*

Satellites are frequently used to detect, track and monitor objects on the earth's surface, such as ships at sea. Space-based missile warning and communications systems are vital elements in the detection of, and response to, strategic attack. Moreover, satellites can provide optical and synthetic aperture radar imagery that will be critically important in determining strategic responses, in making routine targeting decisions, in promoting situational awareness and generally in the conduct of the conflict. Frequently, such systems will be reviewed as part of a "system of systems," i.e., the space-based capability will be part of a greater system that is the subject of the review. Generally speaking, systems, the function of which is the acquisition of timely, accurate and reliable information, are not legally controversial as they tend to promote adherence to the discrimination principle rather than erode it. They will generally have no injurious effect on enemy personnel, will not damage the environment or be used as a weapon. There are no ad hoc rules of the law of armed conflict that prohibit or restrict the use of such technologies.

#### *E. Ground-Based Lasers*

The final method of space warfare to be considered is the use of ground-based lasers to cause power loss in satellites that pass over a high-power laser facility. For the purposes of this final example, it will be assumed that the loss of power suffered by the satellite may be expected to amount to damage of it because the capacity for satellites to carry fuel is so limited and because the restoration of power may be expected to require significant fuel expenditure. As damage is caused, the laser operation will be regarded as an attack with the consequence that the laser facility must be treated as a weapon by virtue of the use to which it is put.

If, as is assumed, the laser system is not being used against enemy personnel, the superfluous injury/unnecessary suffering principle will be of little or no relevance. Likewise, if the laser system has no measurable effect on the environment and is not employing environmental modification techniques, then the environmental protection rules will also be largely irrelevant. The ad hoc rules that deal with laser weapons are found within the Protocol on Blinding Laser Weapons, Protocol IV to the Conventional Weapons Convention.<sup>113</sup> Article 1 prohibits the employment of “laser weapons specifically designed, as their sole combat function or as one of their combat functions, to cause permanent blindness.”<sup>114</sup> If, as is likely, the kind of laser system being discussed now is not designed as a combat function to blind, it will not come within the prohibition in Protocol IV. However, anyone conducting a weapon review of such a system will wish to draw attention to Article 2, which requires that in the employment of laser systems, all feasible precautions be taken to avoid causing blindness.<sup>115</sup>

The main issue to be addressed in a legal review is whether the weapon is capable of being used in compliance with the principle of distinction. Clearly, if the weapon were to be operated without reference to the nature, identity or indeed the nationality of the particular space vehicles that pass overhead, it may be found to breach the indiscriminate weapons rule. If, however, other systems monitor which space vehicles will enter the area of outer space affected by the laser, and if the laser can be switched on and off as required so that only satellites that are military objectives are exposed to the effects of the laser, such a system would be capable of discriminating use.

## IX. CONCLUSION

It can be seen from the foregoing discussion that weapons, methods and means of warfare are regulated by an identifiable body of law comprising customary principles and rules that bind all States, and treaty rules that bind the States that are party thereto. It has been shown that Article III of the Outer Space Treaty applies international law in general to outer space activities, and it seems clear that the law relating to weapons also applies there.

The meanings of the terms “weapon,” “means of warfare” and “method of warfare” have been explained and the principles and rules that determine

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113. *See supra* note 56.

114. Protocol on Blinding Laser Weapons art. 1, Oct. 13, 1995, 1380 U.N.T.S. 370.

115. *Id.* art. 2.

their legality have been discussed and, to the extent possible, clarified. Attention has been drawn to the obligation for all States to conduct weapon reviews in respect of all new weapons and the criteria to be applied during such weapon reviews have been identified. Those criteria have then been applied to a representative selection of space weapon capabilities, and the rules of particular relevance have been noted and explained.

Arguably, Article III of the Outer Space Treaty, which receives relatively little attention, is one of the most important provisions of space law. By applying international law to all military operations in outer space, that provision ensures that the *jus ad bellum* as set forth in the UN Charter is applicable in outer space, that space weapons must comply with weapons law and that their use must adhere to the law of targeting. Any attempts to weaponize outer space are restricted by Article IV of the same treaty, but it would be wrong to pretend that these provisions constitute a comprehensive body of law or even a safeguard on these matters. Perhaps the best protection of outer space from weaponization and aggressive war would lie in a tacit acceptance among all States that the hostility that we see all too readily practiced between States on Earth should not be allowed to escape beyond the atmosphere. The cooperative approach to the use of the International Space Station might suggest that this is not just an idealist's dream. Certainly, the present author fervently hopes that space can remain peaceful, not least because of the potentially dreadful consequences for the earth beneath of a space war aloft. And to anyone who imagines that a new Outer Space Treaty would be the solution to all problems, the following thought is offered. It is sometimes the case that tacit, unwritten, perhaps not even verbalized understandings can be more powerful and better implemented than the most detailed of treaties.